REMARKS

Claim 16 has been amended to incorporate therein the recitation of claim 21, to recite that the negative and positive electrodes have an area ratio which minimizes the element resistance measured therebetween. Claim 21 has been canceled. Claims 31 and 32 have been amended to recite that the sensor comprises a circuit for applying an electric potential between the negative and positive electrodes so that a pump current of less than 100 microamperes flows between the first and second electrodes when the sensor is used to determine the concentration of a gas. This embodiment is described at pages 24-25 of the specification. Claims 27-29 have been rewritten in independent form as new claims 33-35, and to specifically recite that the sensors are an oxygen sensor, a humidity sensor, and a sensor for measuring oxygen as a component of a gas containing Nox, respectively. Claim 36 depending from claim 35 recites that a pump current of less than 10 microamperes flows between the first and second electrodes when the sensor is used to determine oxygen concentration as a component of a gas containing NOx.

It is noted that in the Amendment filed March 9, 2001, the undersigned inadvertently skipped claim 30 when adding new claims 16-32. The same claim numbering has been maintained in this amendment. However, the Examiner is respectfully requested to indicate if the claims should be renumbered.

Entry of the amendments is respectfully requested.

Review and reconsideration on the merits are requested.

Claims 25-32 were rejected under 35 U.S.C. § 102(a) as being anticipated by U.S. Patent 5,672,811 to Kato et al.

The Examiner considered Fig. 2 of Kato et al as showing a sensor including electrodes 28 and 24 formed on the same side of the support, where electrode 28 is about three times as large as electrode 24. Additionally, the Examiner considered that the process limitation (wherein a pump current of less than 100 microamperes flows between the first and second electrodes) defines no structure and therefore does not distinguish over Kato et al.

In response, claims 25-29 have been canceled in favor of new claims 33-36. Claim 30 is missing.

Claims 31 and 32 have been amended to recite that the sensor comprises a circuit for applying an electric potential between the first and second electrodes so that a pump current of less than 100 microamperes flows between the first and second electrodes when the sensor is used to determine the concentration of the gas. New claims 33-36 are similarly limited. Although Kato et al discloses applying a voltage between electrodes 28 and 24 to provide a limiting current, Kato et al does not disclose a sensor configuration including a circuit for applying an electric potential such that the pump current is limited to less than 100 microamperes.

In view of the above amendment, it is submitted that claims 31 and 32 are not anticipated by Kato et al and withdrawal of the foregoing rejection under 35 U.S.C. § 102(a) is respectfully requested.

Claims 16-24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kato et al in view of JP '773 or U.S. Patent 4,657,659 to Mase et al. The Examiner relied on JP '773 and Mase et al as showing electrodes embedded in solid electrolyte members. The reason for

rejection was that it would have been obvious to embed the electrodes of Kato et al as shown by JP '773 or Mase et al in order to provide improved anchoring and protection.

Furthermore, the Examiner considered the recited percentages of resistance values to be inherent in Kato et al. That is, the Examiner considered that because Kato et al shows electrodes provided on the same size of a support having an area ratio within the scope of the claimed invention, the sensor of Kato et al would necessarily also meet the claimed percentages of resistance values.

In response, claim 16 has been amended to incorporate therein the recitation of claim 21, to recite that the negative and positive electrodes have an area ratio which minimizes the element resistance measured therebetween. Although Kato et al may show a negative electrode having an area larger than that of a positive electrode, Kato et al does not show a state where the element resistance is minimized, and further, does not recognize that the element resistance will further increase as the area ratio is increased.

Minimization of the resistance between the positive electrodes formed on the same electrolyte layer is important. Otherwise, stable measurement is not attained when the current between the electrodes is very small. Nothing in the prior art discloses this aspect of the invention.

Withdrawal of all rejections and allowance of claims 16-20, 22-24 and 31-36 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

Respectfully submitted,

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 21 and 25-29 are canceled.

The claims are amended as follows:

16. (Amended) A sensor element comprising negative and positive electrodes disposed on the same side of a solid electrolyte substrate and a circuit for applying an electric potential between said negative electrode and said positive electrode, wherein

the area of said negative electrode and the area of said positive electrode differ by at least twofold and is such that the element resistance measured between the negative and positive electrodes is minimized,

at least one of said negative electrode and said positive electrode is embedded in the solid electrolyte substrate, and

the area ratio of the negative and positive electrodes is such that the element resistance measured between the negative and positive electrodes is 94% or less than the element resistance of the same sensor except in which the negative electrode and the positive electrode have the same area.

31. (Amended) A sensor for detecting an amount of a gas, comprising

an oxygen-ion conductive solid electrolyte substrate having a flat side, a negative electrode and a positive electrode formed on the same flat side of the substrate so as to pump

oxygen from the negative electrode to the positive electrode, and a gas diffusion limiting means for limiting the gas diffusing into the negative electrode,

wherein the ratio of the area of said negative electrode to the area of said positive electrode is set within a range of 2:1 to 5:1, and

[wherein] said sensor comprising a circuit for applying an electric potential between said negative and positive electrodes such that a pump current of less than 100 microamperes flows between the negative and positive electrodes when the sensor is used for detecting the amount of a gas, said pump current being a measurement of the amount of gas.

32. (Amended) A sensor for detecting an amount of a gas, comprising

an oxygen-ion conductive solid electrolyte substrate having a flat side, a negative electrode and a positive electrode formed on the same flat side of the substrate so as to pump oxygen from the negative electrode to the positive electrode, and a gas diffusion limiting means for limiting the gas diffusing into the negative electrode,

wherein the ratio of the area of said negative electrode to the area of said positive electrode is set within a range of 1:2 to 1:5, and

[wherein] said sensor comprising a circuit for applying an electric potential between said negative and positive electrodes such that a pump current of less than 100 microamperes flows between the negative and positive electrodes when the sensor is used to detect the amount of a gas, said pump current being a measurement of the amount of gas.

Claims 33-36 are added as new claims.